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Compositional and Property Optimization of UV-Cured Thick Film Dielectrics on Flexible Films

최홍락, Viswanathan S. Saji, 조용수†

연세대학교 신소재공학과

(ycho@yonsei.ac.kr†)

UV-cureable high k $BaTiO_3$-based materials on flexible substrates have been investigated in terms of physical and dielectric properties of resultant thick films. Dielectric pastes prepared by mixing the $BaTiO_3$ powders and a commercial UV curing polymer using a three-roll mill were printed on flexible ITO films and then cured by exposure to a UV light at a moderate temperature of $< 40^{\circ}C$ up to 60 min in air atmosphere. Dielectric properties of the thick films were measured at room temperature for the samples containing BaTiO3 from 20 to 70 wt. % over the broad frequency range of 103 to 107 Hz. Dielectric constant tended to increase with the increase of $BaTiO_3$ content and to decrease with the increase of frequency. For the optimized composition with $BaTiO_3$ content, promising dielectric constant of >30 and tan $\delta < 0.1$ were obtained. This study proposes the possibility of fabricating flexible high k thick film capacitors by the simple UV curing process at near room temperature.

Keywords: UV-curing, BaTiO3, flexible substrate

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Constrained Sintering of LTCC Heterostructures

임원배, Ravindrassi K. Gupta, 조용수†

연세대학교 신소재공학과

(ycho@yonsei.ac.kr†)

Low temperature co-fired ceramic (LTCC) materials specified with three different dielectric constants (k~8, 14 and 48) were used to produce different LTCC configurations. Fired x-y shrinkage and densification route depended on the relative number of each tape in a given heterostructure. Unexpectedly low x-y shrinkages of 2.5 to 7 % are believed to be associated with the physical constraining effect that results from the dissimilar sintering route and crystallization behavior of each tape. With further correlations between shrinkage behavior and subsequent crystallization, it was concluded that the tape having slower densification rate determines overall x-y shrinkage until the crystallization takes place. It was also confirmed that crystallization of the tape affected sintering negatively, i.e., the densification nearly stopped immediately after the occurrence of crystallization. The tendency of slope variation in the Arrhenius plots of thermo-mechanical curves suggests that increasing the number of embedded tape can produce a potentially less activation energy with a higher x-y shrinkage.

Keywords: LTCC, dielectric constants, heterostructure